

USSN: 10/072,975

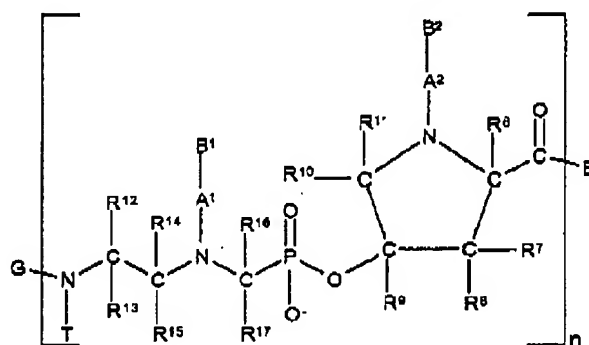
8 SEPT 2004

AMENDMENT

In the claims

1-29. (canceled)

30. (original) A method for inhibiting gene expression, comprising administering an oligonucleotide analogue to at least one cell or at least one organism to inhibit expression of at least one gene that comprises a nucleotide sequence that is at least partially complementary to the oligonucleotide analogue, wherein the oligonucleotide analogue comprises the structure:



wherein G is selected from a group consisting of H and is a protecting group;

wherein E is selected from a group consisting of O-, OH, a protecting group, and an activating group;

wherein n is 1 or greater;

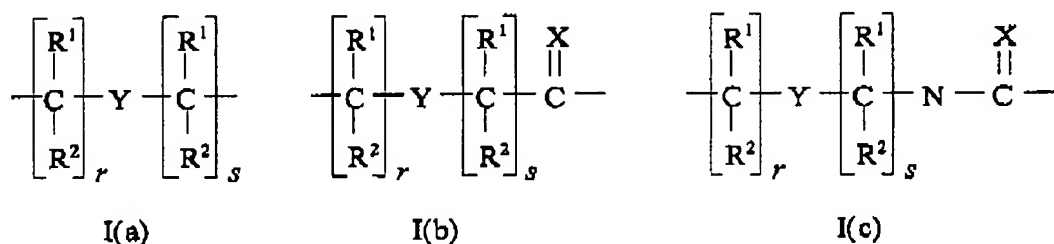
wherein each B¹ and B² is independently selected from the group consisting of H, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic

USSN: 10/072,975

8 SEPT 2004

moiety, a DNA intercalator, a heterocyclic moiety, and a reporter group, wherein amino groups, if present, are, optionally, protected by amino protecting groups;

wherein each A^1 and A^2 is independently selected from the group of consisting of formula (Ia), and (Ib), and (Ic):



wherein each R^1 and R^2 is independently selected from the group of consisting of hydrogen; $(C_1 - C_6)$ alkyl; hydroxy-, alkoxy-, amino-, or alkythio-substituted $(C_1 - C_6)$ alkyl; hydroxy; alkoxy; alkylthio; amino; and halogen;

wherein r and s are, for I(a), and I(b), and I(c) independently of one another, values from 0 to 5;

Y is a single bond, O, S, or NR^4 ;

X is O, S, Se, NR^5 , CH_2 , or $C(CH_3)_2$; and

wherein each R^4 and R^5 is independently selected from the group of consisting of hydrogen; $(C_1 - C_6)$ alkyl; hydroxy-, alkoxy-, amino-, or alkythio-substituted $(C_1 - C_6)$ alkyl; hydroxy; alkoxy; amino; aryl; aralkyl; heteroaryl; and an amino acid side chain;

USSN: 10/072,975

8 SEPT 2004

wherein each R^6 is independently selected from the group of consisting of hydrogen; $(C_1 - C_6)$ alkyl; hydroxy-, alkoxy-, amino-, or alkythio-substituted $(C_1 - C_6)$ alkyl; aryl; aralkyl; heteroaryl; and an amino acid side chain;

wherein each R^7 is independently selected from the group of consisting of hydrogen; $(C_1 - C_6)$ alkyl; hydroxy-, alkoxy-, amino-, or alkythio-substituted $(C_1 - C_6)$ alkyl; hydroxy; alkoxy; alkylthio; amino; aryl; aralkyl; and heteroaryl; and each R^8 is independently selected from the group of consisting of hydrogen; $(C_1 - C_6)$ alkyl; hydroxy-, alkoxy-, amino-, or alkythio-substituted $(C_1 - C_6)$ alkyl; aryl; aralkyl; and heteroaryl; or

wherein each R^7 is independently selected from the group of consisting of hydrogen; $(C_1 - C_6)$ alkyl; hydroxy-, alkoxy-, amino-, or alkythio-substituted $(C_1 - C_6)$ alkyl; aryl; aralkyl; and heteroaryl; and R^8 is independently selected from the group of consisting of hydrogen; $(C_1 - C_6)$ alkyl; hydroxy-, alkoxy-, amino-, or alkythio-substituted $(C_1 - C_6)$ alkyl; hydroxy; alkoxy; alkylthio; amino; aryl; aralkyl; heteroaryl; and halogen;

wherein each R^9 is independently selected from the group of consisting of hydrogen; $(C_1 - C_6)$ alkyl; hydroxy-, alkoxy-, amino-, or alkythio-substituted $(C_1 - C_6)$ alkyl; alkoxy; aryl; aralkyl; and heteroaryl;

wherein each R^{10} and R^{11} is independently selected from the group of consisting of hydrogen; $(C_1 - C_6)$ alkyl; hydroxy-, alkoxy-, amino-, or alkythio-substituted $(C_1 - C_6)$ alkyl; aryl; aralkyl; heteroaryl; and an amino acid side chain;

wherein each R^{12} , R^{13} , R^{14} , R^{15} , R^{16} , and R^{17} is independently selected from the group of consisting of hydrogen; $(C_1 - C_6)$ alkyl; hydroxy-, alkoxy-, amino-, or alkythio-substituted $(C_1 - C_6)$ alkyl; hydroxy; alkoxy; alkylthio; aryl; aralkyl; heteroaryl; and an amino acid side chain; and

USSN: 10/072,975

8 SEPT 2004

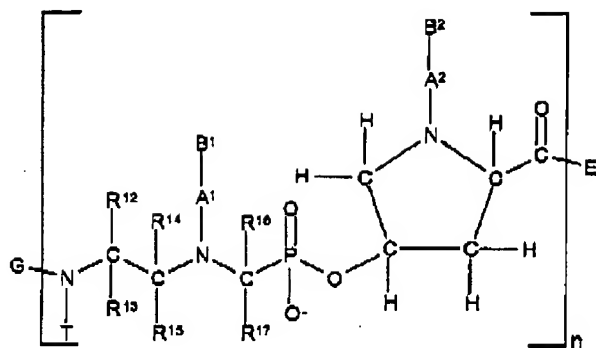
wherein each T is independently selected from the group of consisting of hydrogen; (C₁ – C₆)alkyl; hydroxy-, alkoxy-, amino-, or alkylthio-substituted (C₁ – C₆)alkyl; hydroxy; alkoxy; alkylthio; aryl; aralkyl; heteroaryl; and an amino acid side chain;

and salts thereof.

31. (original) A method according to claim 30 wherein n is less than about 500.
32. (original) A method according to claim 30 wherein n is less than about 50.
33. (original) A method according to claim 30 wherein n is less than about 15.
34. (original) A method according to claim 30 wherein n is selected from the group consisting of 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15.
35. (currently amended) A method according to claim 31 wherein said oligonucleotide analogue comprises a ratio of HypNA to pPNA monomers and wherein the ratio of HypNA to pPNA monomers in the oligonucleotide analogue is from about 2:1 to about 1:3.
36. (currently amended) A method according to claim 31 wherein said oligonucleotide analogue comprises a ratio of HypNA to pPNA monomers and wherein the ratio of HypNA to pPNA monomers in the oligonucleotide analogue is from about 1:1 to about 1:2.
37. (original) A method for inhibiting gene expression, comprising administering an oligonucleotide analogue to at least one cell or at least one organism to inhibit expression of at least one gene that comprises a nucleotide sequence that is at least partially complementary to the oligonucleotide analogue, wherein the oligonucleotide analogue comprises the structure:

USSN: 10/072,975

8 SEPT 2004



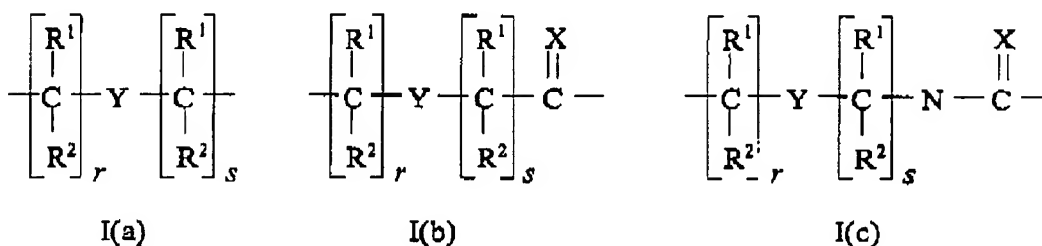
wherein G is selected from a group consisting of H and is a protecting group;

wherein E is selected from a group consisting of O-, OH, a protecting group, and an activating group;

wherein n is 1 or greater;

wherein each B¹ and B² is independently selected from the group consisting of H, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a heterocyclic moiety, and a reporter group, wherein amino groups, if present, are, optionally, protected by amino protecting groups;

wherein each A¹ and A² is independently selected from the group of consisting of formula (Ia), and (Ib), and (Ic):



wherein each R¹ and R² is independently selected from the group of consisting of

USSN: 10/072,975

8 SEPT 2004

hydrogen; (C₁–C₆)alkyl; hydroxy-, alkoxy-, amino-, or alkythio-substituted (C₁–C₆)alkyl; hydroxy; alkoxy; alkylthio; amino; and halogen;

wherein *r* and *s* are, for I(a), ~~and~~ (Ib), and (Ic) independently of one another, values from 0 to 5;

Y is a single bond, O, S, or NR⁴;

X is O, S, Se, NR⁵, CH₂, or C(CH₃)₂; and

wherein each R⁴ and R⁵ is independently selected from the group of consisting of hydrogen; (C₁–C₆)alkyl; hydroxy-, alkoxy-, amino-, or alkythio-substituted (C₁–C₆)alkyl; hydroxy; alkoxy; amino; aryl; aralkyl; heteroaryl; and an amino acid side chain;

wherein each R¹², R¹³, R¹⁴, R¹⁵, R¹⁶, and R¹⁷ is independently selected from the group of consisting of hydrogen; (C₁–C₆)alkyl; hydroxy-, alkoxy-, amino-, or alkythio-substituted (C₁–C₆)alkyl; hydroxy; alkoxy; alkylthio; aryl; aralkyl; heteroaryl; and an amino acid side chain; and

wherein each T is independently selected from the group of consisting of hydrogen; (C₁–C₆)alkyl; hydroxy-, alkoxy-, amino-, or alkythio-substituted (C₁–C₆)alkyl; hydroxy; alkoxy; alkylthio; aryl; aralkyl; heteroaryl; and an amino acid side chain;

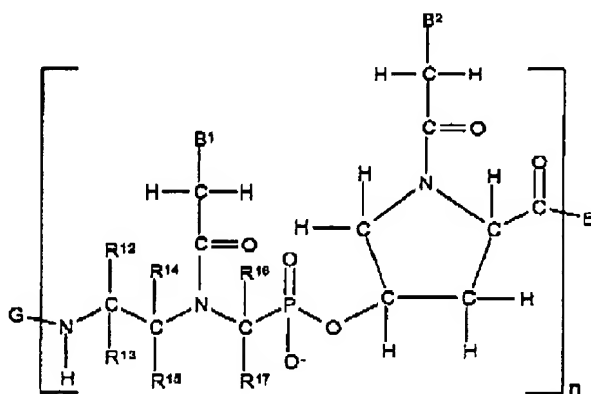
and salts thereof.

38. (currently amended) A method according to claim 37 wherein *n* is less than about 500.
39. (original) A method according to claim 37 wherein *n* is less than about 50.
40. (original) A method according to claim 37 wherein *n* is less than about 15.

USSN: 10/072,975

8 SEPT 2004

41. (original) A method according to claim 37 wherein n is selected from the group consisting of 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15.
42. (currently amended) A method according to claim 38 wherein said oligonucleotide analogue comprises a ratio of HypNA to pPNA monomers and wherein the ratio of HypNA to pPNA monomers in the oligonucleotide analogue is from about 2:1 to about 1:3.
43. (currently amended) A method according to claim 38 wherein said oligonucleotide analogue comprises a ratio of HypNA to pPNA monomers and wherein the ratio of HypNA to pPNA monomers in the oligonucleotide analogue is from about 1:1 to about 1:2.
44. (original) A method for inhibiting gene expression, comprising administering an oligonucleotide analogue to at least one cell or at least one organism to inhibit expression of at least one gene that comprises a nucleotide sequence that is at least partially complementary to the oligonucleotide analogue, wherein the oligonucleotide analogue comprises the structure:



wherein G is selected from a group consisting of H and is a protecting group;

USSN: 10/072,975

8 SEPT 2004

wherein E is selected from a group consisting of O-, OH, a protecting group, and an activating group;

wherein n is 1 or greater;

wherein each B¹ and B² is independently selected from the group consisting of H, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a heterocyclic moiety, and a reporter group, wherein amino groups, if present, are, optionally, protected by amino protecting groups;

wherein each R¹², R¹³, R¹⁴, R¹⁵, R¹⁶, and R¹⁷ is independently selected from the group of consisting of hydrogen; (C₁ - C₆)alkyl; hydroxy-, alkoxy-, amino-, or alkythio-substituted (C₁ - C₆)alkyl; hydroxy; alkoxy; alkylthio; aryl; aralkyl; heteroaryl; and an amino acid side chain; and

wherein each T is independently selected from the group of consisting of hydrogen; (C₁ - C₆)alkyl; hydroxy-, alkoxy-, amino-, or alkythio-substituted (C₁ - C₆)alkyl; hydroxy; alkoxy; alkylthio; aryl; aralkyl; heteroaryl; and an amino acid side chain;

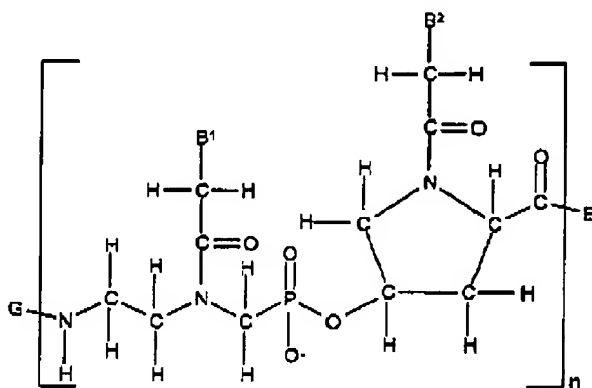
and salts thereof.

45. (original) A method according to claim 44 wherein n is less than about 500.
46. (original) A method according to claim 44 wherein n is less than about 50.
47. (original) A method according to claim 44 wherein n is less than about 15.
48. (original) A method according to claim 44 wherein n is selected from the group consisting of 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15.

USSN: 10/072,975

8 SEPT 2004

49. (currently amended) A method according to claim 45 wherein said oligonucleotide analogue comprises a ratio of HypNA to pPNA monomers and wherein the ratio of HypNA to pPNA monomers in the oligonucleotide analogue is from about 2:1 to about 1:3.
50. (currently amended) A method according to claim 45 wherein said oligonucleotide analogue comprises a ratio of HypNA to pPNA monomers and wherein the ratio of HypNA to pPNA monomers in the oligonucleotide analogue is from about 1:1 to about 1:2.
51. (original) A method for inhibiting gene expression, comprising administering an oligonucleotide analogue to at least one cell or at least one organism to inhibit expression of at least one gene that comprises a nucleotide sequence that is at least partially complementary to the oligonucleotide analogue, wherein the oligonucleotide analogue comprises the structure:



wherein G is selected from a group consisting of H and is a protecting group;

wherein E is selected from a group consisting of O-, OH, a protecting group, and an activating group;

wherein n is 1 or greater;

USSN: 10/072,975

8 SEPT 2004

wherein each B¹ and B² is independently selected from the group consisting of H, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a heterocyclic moiety, and a reporter group, wherein amino groups, if present, are, optionally, protected by amino protecting groups; and

wherein each T is independently selected from the group of consisting of hydrogen; (C₁ – C₆)alkyl; hydroxy-, alkoxy-, amino-, or alkylthio-substituted (C₁ – C₆)alkyl; hydroxy; alkoxy; alkylthio; aryl; aralkyl; heteroaryl; and an amino acid side chain;

and salts thereof.

52. (original) A method according to claim 51 wherein n is less than about 500.
53. (original) A method according to claim 51 wherein n is less than about 50.
54. (original) A method according to claim 51 wherein n is less than about 15.
55. (original) A method according to claim 51 wherein n is selected from the group consisting of 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15.
56. (currently amended) A method according to claim 52 wherein said oligonucleotide analogue comprises a ratio of HypNA to pPNA monomers and wherein the ratio of HypNA to pPNA monomers in the oligonucleotide analogue is from about 2:1 to about 1:3.
57. (currently amended) A method according to claim 52 wherein said oligonucleotide analogue comprises a ratio of HypNA to pPNA monomers and wherein the ratio of HypNA to pPNA monomers in the oligonucleotide analogue is from about 1:1 to about 1:2.